overcapacity. In addition, the increasing use of automatic controls and more efficient equipment in new plants should require fewer operators.

Earnings

Median annual earnings of power generating and reactor plant operators were $44,840 in 1998. The middle 50 percent earned between $37,190 and $50,940 a year. The lowest 10 percent earned less than $29,000 and the highest 10 percent earned more than $73,090 a year. Median annual earnings of power generating plant operators in 1997 were $43,800 in electric services.

Median annual earnings of power distributors and dispatchers were $45,690 in 1998. The middle 50 percent earned between $37,350 and $56,810 a year. The lowest 10 percent earned less than $29,620 and the highest 10 percent earned more than $78,060 a year.

According to information from union surveys, average annual earnings for fossil fuel power plant operators were about $46,500 in 1999. Nuclear power plant operators earned an average of about $56,200 annually in 1998. Senior or chief operators earned 10 to 15 percent more than operators did. Over half of all electric power generating plant operators and power distributors and dispatchers were union members.

Related Occupations

Other workers who monitor and operate plant and systems equipment include stationary engineers, water and wastewater treatment plant operators, waterworks pumpstation operators, chemical plant and system operators, and refinery operators.

Sources of Additional Information

For information about employment opportunities, contact local electric utility companies, locals of unions mentioned below, and an office of the State employment service.

For general information about power plant and nuclear reactor operators and power distributors and dispatchers, contact:

☛ International Brotherhood of Electrical Workers, 1125 15th St. NW., Washington, DC 20005.

☛ Utility Workers Union of America, 815 16th St. NW., Washington, DC 20006.

Stationary Engineers

(O*NET 95032)

Significant Points

- Job opportunities will be best for workers with computer training.
- Stationary engineers usually acquire their skills through a formal apprenticeship program or informal on-the-job training supplemented by courses at a trade or technical school.
- A license to operate boilers, ventilation, air conditioning, and other equipment is required in most States and cities.

Nature of the Work

Heating, air-conditioning, and ventilation systems keep large buildings comfortable all year long. Industrial plants often have facilities to provide electrical power, steam, or other services. Stationary engineers operate and maintain these systems, which can include boilers, air-conditioning and refrigeration equipment, diesel engines, turbines, generators, pumps, condensers, and compressors. The equipment stationary engineers operate is similar to equipment operated by locomotive or marine engineers, except it is not on a moving vehicle.

Stationary engineers start up, regulate, and shut down equipment. They ensure that it operates safely, economically, and within established limits by monitoring meters, gauges, and computerized controls. They manually control equipment and, if necessary, make adjustments. They use hand and power tools to perform repairs and maintenance ranging from a complete overhaul to replacing defective valves, gaskets, or bearings. They also record relevant events and facts concerning operation and maintenance in an equipment log. On steam boilers, for example, they observe, control, and record steam pressure, temperature, water level and chemistry, power output, fuel consumption, and emissions. They watch and listen to machinery and routinely check safety devices, identifying and correcting any trouble that develops.

Increasingly, stationary engineers use computers to operate the mechanical systems of new buildings and plants. Engineers monitor, adjust, and diagnose these systems from a central location or from a laptop computer linked into the buildings' communications network.

Routine maintenance, such as lubricating moving parts, replacing filters, and removing soot and corrosion that can reduce operating efficiency, is a regular part of the work of stationary engineers. They test boiler water and add chemicals to prevent corrosion and harmful deposits. They also may check the air quality of the ventilation system and make adjustments to keep within mandated guidelines.

In a large building or industrial plant, a stationary engineer may be in charge of all mechanical systems in the building. Engineers may supervise the work of assistant stationary engineers, turbine operators, boiler tenders, and air-conditioning and refrigeration operators and mechanics. Some perform other maintenance duties, such as carpentry, plumbing, and electrical repairs. In a small building or industrial plant, there may be only one stationary engineer.

Stationary engineers increasingly use computers to operate the mechanical systems of new buildings and plants.

Working Conditions
Stationary engineers generally have steady, year-round employment. The average workweek is 40 hours. In facilities that operate around the clock, an engineer usually works one of three daily 8-hour shifts on a rotating basis. Weekend and holiday work often is required.

Engine rooms, power plants, and boiler rooms usually are clean and well lighted. Even under the most favorable conditions, however, some stationary engineers are exposed to high temperatures, dust, dirt, and high noise levels from the equipment. General maintenance duties may also require contact with oil, grease, or smoke. Workers spend much of their time on their feet. They may also have to crawl inside boilers and work in crouching or kneeling positions to inspect, clean, or repair equipment.

Stationary engineers work around potentially hazardous machinery such as boilers and electrical equipment. They must follow procedures to guard against burns, electric shock, and exposure to hazardous materials such as asbestos or certain chemicals.

Employment
Stationary engineers held about 31,000 jobs in 1998. They worked in a variety of places, including factories, hospitals, hotels, office and apartment buildings, schools, and shopping malls. Some are employed as contractors to a building or plant.

Stationary engineers work throughout the country, generally in the more heavily populated areas where large industrial and commercial establishments are located.

Training, Other Qualifications, and Advancement
Stationary engineers usually acquire their skills through a formal apprenticeship program or informal on-the-job training supplemented by courses at a trade or technical school. In addition, valuable experience can be obtained in the Navy or the Merchant Marine because marine-engineering plants are similar to many stationary power and heating plants. Most employers prefer to hire persons with at least a high school diploma or its equivalent due to the increasing complexity of the equipment engineers work with. Many stationary engineers have some college education. Mechanical aptitude, manual dexterity, and good physical condition also are important.

The International Union of Operating Engineers sponsors apprenticeship programs and is the principal union for stationary engineers. In selecting apprentices, most local labor-management apprenticeship committees prefer applicants with education or training in mathematics, computers, mechanical drawing, machine-shop practice, physics, and chemistry.

An apprenticeship usually lasts 4 years and includes 8,000 hours of on-the-job training. In addition, apprentices receive 600 hours of classroom instruction in subjects such as boiler design and operation, elementary physics, pneumatics, refrigeration, air conditioning, electricity, and electronics.

Those who acquire their skills on the job usually start as boiler tenders or helpers to experienced stationary engineers. This practical experience may be supplemented by postsecondary vocational training in computerized controls and instrumentation. However, becoming a stationary engineer without completing a formal apprenticeship program usually requires many years of work experience.

Most large and some small employers encourage and pay for skill-improvement training for their employees. Training is almost always provided when new equipment is introduced or when regulations concerning some aspect of their duties change.

Most States and cities have licensing requirements for stationary engineers. Applicants usually must be at least 18 years of age, reside for a specified period in the State or locality, meet experience requirements, and pass a written examination. A stationary engineer who moves from one State or city to another may have to pass an examination for a new license due to regional differences in licensing requirements.

There are several classes of stationary engineer licenses. Each class specifies the type and size of equipment the engineer can operate without supervision. A licensed first-class stationary engineer is qualified to run a large facility, supervise others, and operate equipment of all types and capacities. An applicant for this license may be required to have a high school education, apprenticeship or on-the-job training, and several years of experience. Licenses below first class limit the types or capacities of equipment the engineer may operate without supervision.

Stationary engineers advance by being placed in charge of larger, more powerful, or more varied equipment. Generally, engineers advance to these jobs as they obtain higher class licenses. Some stationary engineers advance to boiler inspectors, chief plant engineers, building and plant superintendents, or building managers. A few obtain jobs as examining engineers or technical instructors.

Job Outlook
Persons wishing to become stationary engineers may face competition for job openings. Employment opportunities will be best for those with apprenticeship training or vocational school courses covering systems operation using computerized controls and instrumentation.

Employment of stationary engineers is expected to decline through the year 2008. Continuing commercial and industrial development will increase the amount of equipment to be operated and maintained. However, automated systems and computerized controls are making newly-installed equipment more efficient, thus reducing the number of jobs needed for their operation. Some job openings will arise from the need to replace experienced workers who transfer to other occupations or leave the labor force. However, turnover in this occupation is low, partly due to its high wages. Consequently, relatively few replacement openings are expected.

Earnings
Median annual earnings of stationary engineers were $38,270 in 1998. The middle 50 percent earned between $31,560 and $46,390 a year. The lowest 10 percent earned less than $24,910 and the highest 10 percent earned more than $55,730 a year.

Related Occupations
Other workers who monitor and operate stationary machinery include nuclear reactor operators, power station operators, water and wastewater treatment plant operators, waterworks pump-station operators, chemical plant and system operators, and refinery operators. Often, workers who operate and maintain all of the equipment in a building or plant are called general maintenance mechanics.

Sources of Additional Information
Information about apprenticeships and vocational training or work opportunities is available from local offices of State employment services, locals of the International Union of Operating Engineers, vocational schools, and from State and local licensing agencies.

Specific questions about this occupation should be addressed to:

☛ International Union of Operating Engineers, 1125 17th St. NW., Washington, DC 20036. Internet: **http://www.iuoe.org**

☛ National Association of Power Engineers, Inc., 1 Springfield St., Chicopee, MA 01013. Internet: **http://www.powerengineers.com**

☛ Building Owners and Managers Institute International, 1521 Ritchie Hwy., Arnold, MD 21012. Internet: **http://www.bomi-edu.org**

Water and Wastewater Treatment Plant Operators

(O*NET 95002A)

Significant Points

- Employment is concentrated in local government and private water supply and sanitary services companies.
- Although completion of high school continues to be sufficient for most jobs, postsecondary training is increasingly an asset as new water pollution control standards make treatment plants more complex.